

## Description of *Heteroptectanum oliveri* sp. n. (Monogenea: Diplectanidae) and Comments on the Helminth Fauna of *Kyphosus elegans* (Perciformes: Kyphosidae) from Chamela Bay, México

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**ABSTRACT:** *Heteroptectanum oliveri* sp. n. (Monogenea: Monopisthocotylea: Diplectanidae) is described from *Kyphosus elegans* Peters, 1869 (Perciformes: Kyphosidae) in Chamela Bay, Jalisco, México. It differs from other species of the genus in the structure of the cirrus complex, in having a spined cirrus and a strongly sclerotized genital atrium. Eight additional helminth species are reported in *K. elegans*: *Heteroptectanum nenu* (Yamaguti, 1968) *Rakotofringa*, Oliver and Lambert, 1987, *H. kyphosi* (Yamaguti, 1968) Oliver, 1987, *Neobivagina aniversaria* Bravo-Hollis, 1979, *Deontacylix ovalis* Linton, 1910, *Opisthadena dimidia* Linton, 1910, *Jeancadenatia dohenyi* Winter, 1956, *Filisoma bucerium* Van Cleave, 1940, and *Ascarophis girellae* Yamaguti, 1935, and Anguillicolidae Yamaguti, 1935 (larvae). Chamela Bay is a new locality for all helminth species, except for *N. aniversaria*. *Kyphosus elegans* is a new host for *D. ovalis*, *Ascarophis girellae*, and Anguillicolidae larvae. Taxonomic problems associated with these helminths are discussed, and the importance of the *Kyphosus* host-parasite system as a coevolving unit is stressed.

**KEY WORDS:** *Heteroptectanum oliveri* sp. n., *H. nenu*, *H. kyphosi*, *Neobivagina aniversaria*, *Deontacylix ovalis*, *Opisthadena dimidia*, *Jeancadenatia dohenyi*, *Filisoma bucerium*, *Ascarophis girellae*, Anguillicolidae, *Kyphosus elegans*, México.

We have been collecting helminths from marine and brackish water fishes from Chamela Bay, on the west coast of México, since 1992. During this survey, 18 specimens of *Kyphosus elegans* Peters, 1869, were collected and analyzed for helminths. *Kyphosus elegans*, regionally called *chopa*, is a tropical reef fish with herbivorous feeding habits and some commercial importance; its geographical distribution comprises the Pacific coast of the Americas, between the Gulf of California and the Galapagos Islands (Castro-Aguirre, 1978). Manter (1949, 1965) first recognized the genus *Kyphosus* Lacépède as a host with considerable parasitological interest and suggested it as an excellent model to study the origin and dispersal routes of both hosts and parasites. Many collections of *Kyphosus* and their parasites have been made in the eastern Pacific (Van Cleave, 1940; Winter, 1956; Lamothe, 1961; Bravo-Hollis, 1965, 1979), Caribbean Sea (Sierra, 1984), and Gulf of México (Linton, 1910; Manter, 1947, 1949; Van Cleave and Manter, 1948; Overstreet, 1969). In this paper, we describe a new species of monogenean, charac-

terize the helminth fauna of *K. elegans* from Chamela Bay, and address questions to be answered by a long-term survey related to the historical ecology (Brooks, 1985; Brooks and McLennan, 1991, 1993) and biogeography of this host-parasite system.

### Materials and Methods

A total of 18 fishes were collected in Chamela Bay using gill nets, in August 1993, February and May 1995, and January 1996. This bay is located on the west coast of México, in the state of Jalisco, 19°30'–19°32'N, 105°06'W. Fish were examined no more 4 hr after capture; gills and viscera were obtained from each host and analyzed for helminths using a stereomicroscope.

Once collected, most monogeneans and digeneans were killed with boiling water and fixed under slight coverglass pressure using Bouin's fluid. Acanthocephalans were kept in distilled water at 4°C for 12 hr and fixed in 70% ethanol. Nematodes were killed with 70% boiling alcohol. Monogeneans, digeneans, and acanthocephalans were stained with Delafield and Van Cleave's hematoxylin, dehydrated in a graded alcohol series, cleared with methyl salicylate, and mounted in Canada balsam. Nematodes were mounted as semipermanent slides using lactophenol as a clearing agent. Measurements are expressed in micrometers; average is indicated with a range, in parentheses. Drawings were made using a camera lucida. Specimens were deposited in the Colección Nacional de Helmintos

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(CNHE), México, and in the United States National Parasite Collection (USNPC), Beltsville, Maryland.

### Results

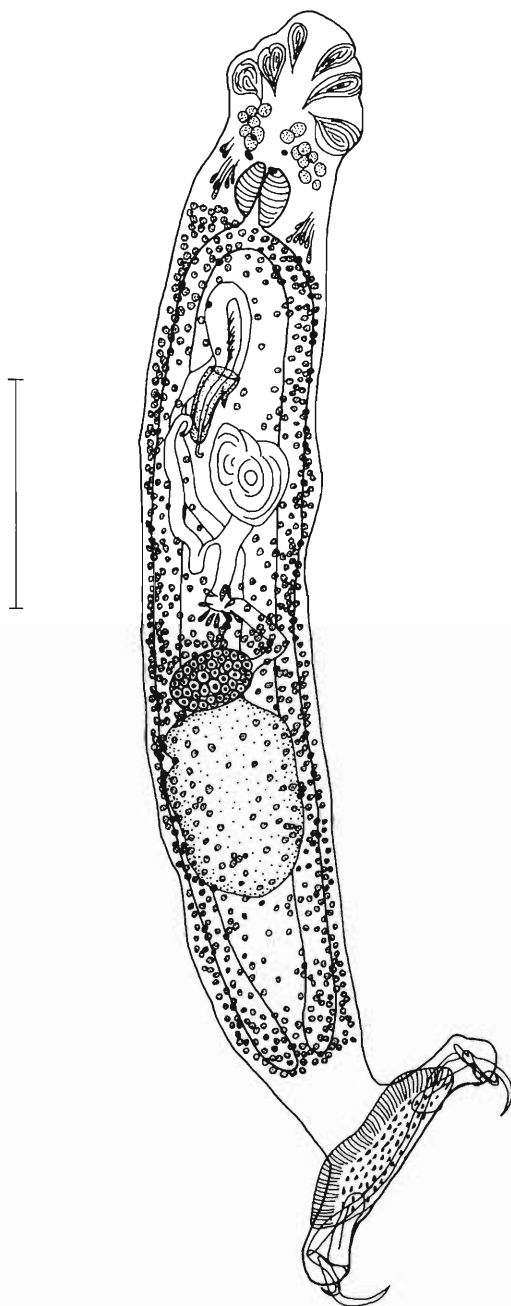
#### *Heteroplectanum oliveri* sp. n.

(Figs. 1–3)

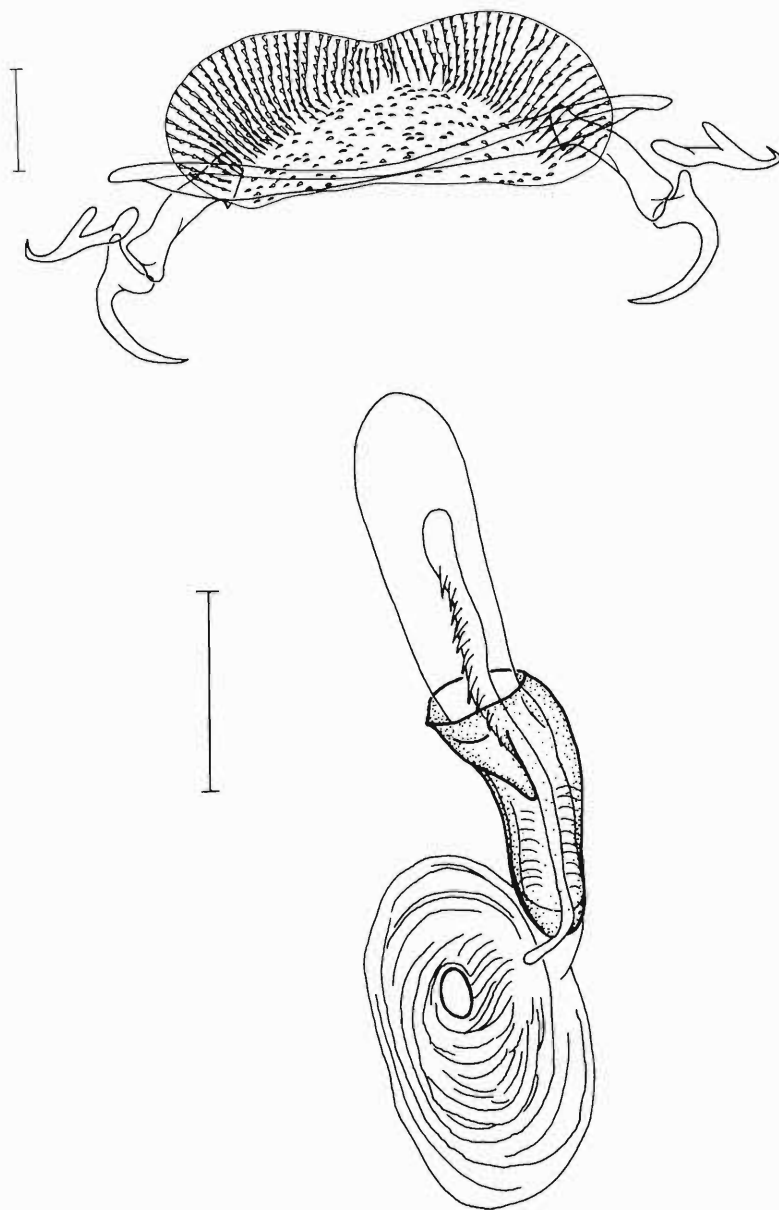
**DESCRIPTION:** The following description is based on 48 specimens collected from *Kyphosus elegans*. Body slender, 895 (788–1,062) long by 148 (125–175) wide. Haptor clearly differentiated from the rest of the body, 253 (246–267) wide. Anterior region shows 3 pairs of cephalic organs and 2 pairs of eyespots.

Opisthaptor provided with 2 pairs of lateral anchors. The dorsal pair points outward, 58 (51–75) long by 10 (9–12) wide at level of root; the ventral pair points inward, has a bifurcated root, and is 64 (51–75) long by 27 (24–30) wide at level of root. There is a pair of lateral bars 59 (54–66) long by 19 (18–21) wide and a central bar with blunt ends, 221 (216–225) long by 11 (6–15) wide (Fig. 2). Seven marginal hooklets are present. There are 2 squamodiscs (1 ventral and 1 dorsal). They are composed of 63–65 radiating rows of rodlets in its anterior region and semicircular lines of tiny scales in the posterior region (Fig. 2). Mouth opening in prohaptor, at level of lateral head lobes. Pharynx 38 (24–51) long by 37 (33–48) wide. Esophagus inconspicuous; ceca simple, terminating separately midway between testis and opisthaptor. Testis ovoid, postequatorial, 146 (126–162) long by 83 (69–114) wide. Vas deferens arises from anterior end of testis and extends forward to form a tubular seminal vesicle. Cirrus sac muscular, immediately postbifurcal, divided in 2 portions; 1 anterior and proximal, bulbous, 82 (76–88) long by 34 (27–45) wide, distal portion strongly cuticularized, funnel-shaped, with a spur in its proximal region, 66 (60–75) long by 28 (27–30) maximum width. Cirrus spined, 115 (105–123) long (Fig. 3). Ovary immediately anterior to testis, laterally elongated, 35 (27–45) long by 60 (45–75) wide; oviduct embraces right cecum. Mehlis gland directly anterior to ovary. Uterus intercecal, running forward to female genital pore, situated posterior and right of the male genital pore. Sclerotized genital atrium. Vagina situated on the left side of body, running forward and reaching the level of male genital pore. Vitelline follicles extending in lateral fields from the bifurcation to the end of intestinal ceca.

**TYPE HOST:** *Kyphosus elegans* Peters, 1869.



**Figure 1.** Holotype of *Heteroplectanum oliveri* sp. n. from *Kyphosus elegans* in Chamela Bay, Jalisco, México. Dorsal view. Scale bar = 0.2 mm.



Figures 2, 3. *Heteroplectanum oliveri* sp. n. 2. Anchor/bar complex and squamodisc. 3. Genital complex. Scale bars = 0.05 mm.

TYPE LOCALITY: Chamela Bay, Jalisco, México.

SITE OF INFECTION: Gills.

ACCESSION NUMBERS: Holotype CNHE 2728; paratypes CNHE 2729 and USNPC 84878.

ETYMOLOGY: The new species is named in honor of Dr. Guy Oliver, for his wide contribu-

tion to the knowledge of this group of monogeneans.

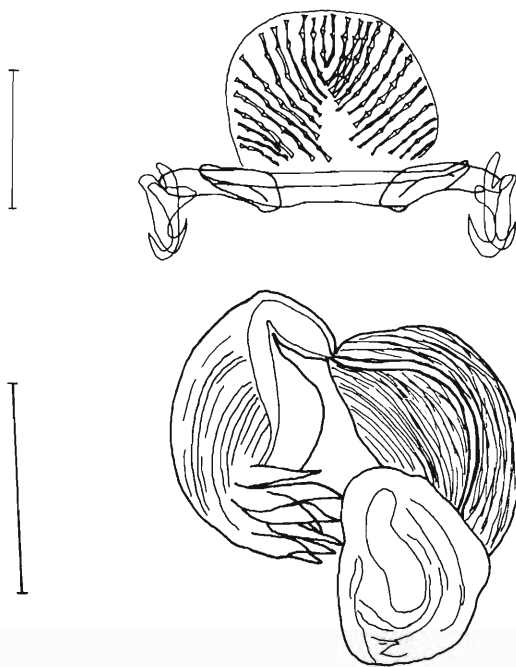
REMARKS: The structure of the squamodisc, with central rows in the form of a V, the shape of the central haptoral bar, and the distribution of the cephalic organs in 3 pairs identify these specimens as members of the genus *Heteroplectanum* Rakotofringa, Oliver, and Lambert, 1987.

This genus was erected to include the species *H. nenuoides* and *H. serrulopenis*, described in *Rhabdosargus sarba* Försskal and *Polyamblyodon gibbosum* Pellegrin (Sparidae), *H. tamatavense* in *P. gibbosum*, and *H. parastromatei* in *Parastromateus niger* Bloch (Carangidae) from Madagascar. Rakotofiringa et al. (1987) also transferred the species *Diplectanum nenu* and *D. diplobulbus* described by Yamaguti (1968) in *Kyphosus cinerascens* (Forsk.) from Hawaii to this genus. Oliver (1987) additionally transferred *D. spiculare* Yamaguti, 1968, *D. kyphosi* Yamaguti, 1968, and *D. yamagutii* Oliver, 1983, the 3 of them described in *K. cinerascens* in Hawaii (Yamaguti, 1968; Oliver, 1983).

The new species differs from *H. nenuoides*, *H. parastromatei*, *H. diplobulbus*, and *H. nenu* in the structure of the squamodisc, which is transversely elongated in *H. oliveri* and bears a higher number of sclerified ridges; in the scales posterior to the squamodisc, and in the structure of the cirrus complex, which is constituted in 2 parts, 1 muscular and proximal and 1 sclerified and distal. The new species differs from *H. kyphosi*, *H. tamatavense*, *H. yamaguti*, and *H. spiculare* in the structure of the cirrus complex, which is formed by a sinuous sclerified piece in its distal end in the former species and a large spicule in *H. spiculare*, whereas in *H. oliveri* it is funnel-shaped.

The new species most closely resembles *H. serrulopenis* because of the squamodisc structure, the structure of the cirrus sac, which is divided into 2 regions—the proximal part bulbous and the distal part sclerotized—and the spined character of the cirrus, but it differs from this species in the shape of the distal part of the cirrus sac, which in *H. oliveri* is more developed and bears a conspicuous spur in its proximal end. The distal part of the uterus is also sclerotized in *H. serrulopenis* but not so markedly as in *H. oliveri* (Oliver, pers. comm.). In addition, the general size of the body and organs of *H. oliveri* are smaller. These characters do not vary among the 48 specimens examined; thus, we think that the differences between *H. serrulopenis* and *H. oliveri* could not be considered a result of intraspecific variation.

*Heteroplectanum serrulopenis* was described in 2 species of fishes from the family Sparidae in Madagascar; it is difficult to conceive the presence of the same species parasitizing a non-related host species along the Pacific coast of

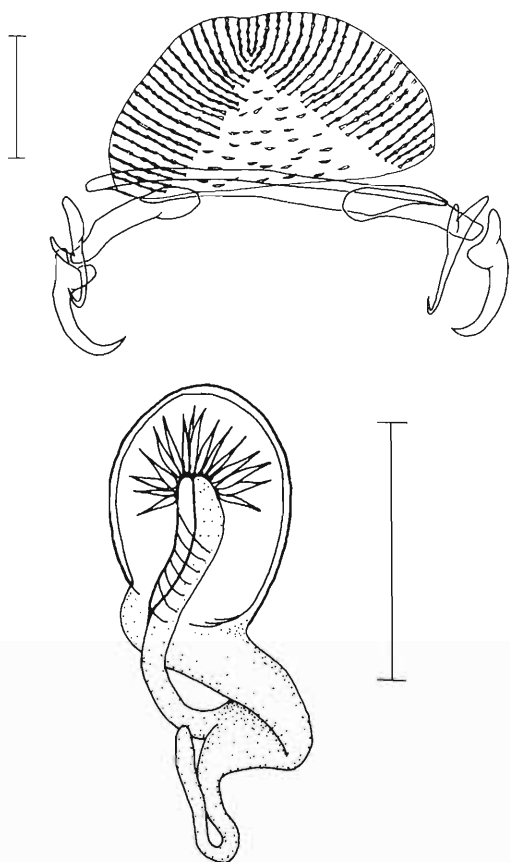


Figures 4, 5. *Heteroplectanum nenu* (Yamaguti, 1968) Rakotofiringa, Oliver, and Lambert, 1987. 4. Anchor/bar complex and squamodisc. 5. Genital complex. Scale bars = 0.05 mm.

México, considering that *H. oliveri* is highly specific to *K. elegans*. The finding of 2 of the Hawaiian species sympatric with *H. oliveri* suggests that the new species could be the sister species of one of those originally described from Hawaii. The high resemblance to *H. serrulopenis* would then be the result of convergent evolution. The phylogenetic and biogeographical study of this group of monogeneans has interesting aspects that deserve further attention.

***Heteroplectanum nenu* (Yamaguti, 1968)  
Rakotofiringa, Oliver, and Lambert, 1987  
(Figs. 4, 5)**

Yamaguti (1968) originally described this species as *Diplectanum nenu* Yamaguti, 1968, as a parasite of *Kyphosus cinerascens* in Hawaii, and later it was transferred to the genus *Heteroplectanum* Rakotofiringa, Oliver, and Lambert, 1987. This species differs from *H. oliveri* in the number of rows forming the squamodisc (13 vs. 63–65 in the new species) (Fig. 4) and in the structure of the male genitalia, which is formed by a muscular elongate proximal part, an ejaculatory bulb, and a bulbous distal zone ending



Figures 6, 7. *Heteroplectanum kyphosi* (Yamaguti, 1968) Oliver, 1987. 6. Anchor/bar complex and squamodisc. 7. Genital complex. Scale bars = 0.05 mm.

with several foliaceous projections. This report represents a new host and locality record.

SITE OF INFECTION: Gills.

ACCESSION NUMBER: CNHE 2730.

***Heteroplectanum kyphosi* (Yamaguti, 1968)  
Oliver, 1987  
(Figs. 6, 7)**

*Heteroplectanum kyphosi*, originally described as *Acleotrema kyphosi* Yamaguti, 1968, in *Kyphosus cinerascens* in Hawaii (Yamaguti, 1968), differs from *H. oliveri* and *H. nenu* in the number of rows forming the squamodisc (20 in *H. kyphosi* vs. 63–65 in *H. oliveri* and 13 in *H. nenu*) (Fig. 6); it also differs in the structure of the cirrus complex, which is formed by a sinuous sclerotized piece and lacks a spined cirrus

(Fig. 7). This represents a new host and locality record for *H. kyphosi*.

SITE OF INFECTION: Gills.

ACCESSION NUMBER: CNHE 2731.

***Neobivagina aniversaria* Bravo-Hollis, 1979**

The monogenean *Neobivagina aniversaria* was originally described from *Kyphosus* sp. (Bravo-Hollis, 1979) and later reported from *Sectator ocyurus* (Bravo-Hollis, 1981) in the same locality as our specimens. We have examined 114 different fish species in this locality and confirmed that *N. aniversaria* preferentially parasitizes members of the Kyphosidae, although it has also been occasionally collected from *Lutjanus guttatus* and *Prioporus punctatus*.

SITE OF INFECTION: Gills.

ACCESSION NUMBERS: CNHE 2732; USNPC 84879.

***Deontacylix ovalis* Linton, 1910**

*Deontacylix ovalis* is a sanguinicolid digenean that lives in the vascular system of fish and was previously described from *K. sectatrix* and *K. incisor* in Florida by Linton (1910) and Manter (1947). This report represents a new host and locality record.

SITE OF INFECTION: Blood vessels.

ACCESSION NUMBER: CNHE 2733.

***Opisthadenia dimidia* Linton, 1910**

The genus *Opisthadenia* Linton, 1910, comprises 9 species distributed mainly in tropical marine fish all over the world. The taxonomy of the genus is difficult because the characters that have been used to distinguish species show great intraspecific variation. Our specimens resemble most *O. dimidia* Linton, 1910, but differ from the description by Linton (1910) in having a wider distance between testes and between the ovary and testes. The 5 pairs of oral papillae described by Manter (1947) were not observed in a constant number but varied from 3 to 5 pairs. The number of papillae was used in the erection of *O. cheni* Martin, 1978, as a useful character (Martin, 1978). We question the validity of this trait as a taxonomic character, because in our observation of type specimens of *O. dimidia* (USNPC 8489), *O. bodegensis* Johnson and Copsey, 1957 (USNPC 37338), and *O. cortesi* Bravo, 1956 (CNHE 219-25), we noticed that the number of papillae vary greatly among specimens of the same species. The observation of

the types of *O. kyphosi* Yamaguti, 1970 (USNPC 63790), showed that the use of the presence or absence of the oral papillae, in contrast, is a useful character to differentiate species. Taxonomic revision and phylogenetic analysis of this genus is necessary to support or refute the validity of the present classification. *Opisthadenia dimidia* is a specialist parasite of fishes of the genus *Kyphosus* along the Pacific and Atlantic coasts of tropical America, and the related species *O. kyphosi* and *O. cheni* are typical of fishes of the same family (Kyphosidae) in Hawaii and California, respectively. This makes phylogenetic analysis of the genus an important one, because it may be a significant part of any biogeographical analysis of the genus *Kyphosus* and its helminths. León-Règagnon et al. (1996) address these subjects. This report represents a new locality record for *Opisthadenia dimidia*.

SITE OF INFECTION: Stomach.

ACCESSION NUMBERS: CNHE 2631, 2632; USNPC 84875.

#### ***Jeancadenatia dohenyi* Winter, 1956**

The genus *Jeancadenatia* was erected by Dollfus (1946) for *J. brumpti* Dollfus, 1946, from *Kyphosus sectatrix* in Africa. Subsequently, 2 additional species have been described, *J. dohenyi* Winter, 1956, from *K. elegans* from Nayarit State, on the Pacific coast of México, and *J. pacifica* Yamaguti, 1970, from *K. cinerascens* from Hawaii. In its original diagnosis, this genus differs from the related *Cadenatella* Dollfus, 1946, and *Enenterum* Linton, 1910, in body length, number of preoral lobes, and accessory suckers. When Winter (1956) described *J. dohenyi*, he emended the generic diagnosis, because the new species bore only 2 accessory suckers instead of the "many" that Dollfus (1946) stated. Later, Yamaguti (1970) included *J. pacifica* in this genus because of the resemblance in internal structures, although the species has only 8 rather than 10 preoral lobes. We examined the type specimen of *J. dohenyi* (CNHE 215-9) and observed that our specimens are identical to those described by Winter, bearing 10 oral lobes and 2 accessory suckers. This report represents a new locality for *J. dohenyi*.

The differences among species of the genera *Enenterum*, *Cadenatella*, and *Jeancadenatia* are not pronounced, leading Nahhas and Cable (1964) to declare *Jeancadenatia* a synonym of *Cadenatella*. In addition to that, Gibson and

Bray (1982) and Bray (1986) have included several genera of opecoelids and lepecreadids within the family Enenteridae based on genital structures, although their specimens lack the preoral lobes that are diagnostic of the family. A thorough study of the phylogenetic relationships among the genera of this family will be necessary to provide a stable classification.

SITE OF INFECTION: Intestine.

ACCESSION NUMBERS: CNHE 2734; USNPC 84976.

#### ***Filisoma bucerium* Van Cleave, 1940**

The acanthocephalan *Filisoma bucerium* was originally described by Van Cleave (1940) from *K. elegans* from Isla Socorro, México. Our specimens, found in the same host and geographic zone, show the typical features of this species, 16 rows of 38–40 hooks in the proboscis. The hooks of the middorsal row are modified, being heavy and blunt. This report represents a new locality for *F. bucerium*.

The genus *Filisoma* Van Cleave, 1940, comprises 5 species, 2 of which were described from freshwater fish: *F. indicum* Van Cleave, 1928, in India and *F. microcanthi* Harada, 1938, in Japan. A third species, *F. rizalinum* Tubangi and Masilungan, 1946, was described from the same host as *F. microcanthi*, but from Manila Bay, in the Philippine Islands. The other 2 species were found in New World fishes of the genus *Kyphosus*: *F. bucerium* Van Cleave, 1940, from *K. elegans* in the Pacific Ocean and *F. fidum* Van Cleave and Manter, 1948, from *K. sectatrix* in Florida (Van Cleave and Manter, 1948). *Filisoma bucerium* has also been found in *Caranx hippos* from Oaxaca State, on the Pacific coast of México (Salgado, 1978), but those specimens were much smaller than those in *Kyphosus* spp. The specificity shown by the species of this genus to fishes of the genus *Kyphosus* and their restricted geographical distribution also provide an interesting host–parasite system for zoogeographical studies.

SITE OF INFECTION: Intestine.

ACCESSION NUMBERS: CNHE 2735; USNPC 84877.

#### ***Ascarophis girellae* (Yamaguti, 1935) Campana, 1955**

Our specimens of *Ascarophis* show the lateral lips, transversely striated cuticle, postequatorial vulva, and filamented eggs that characterize the

genus. Caballero (1975) described *Ascarophis ayalai* from *Arius liropus* collected in coastal lagoons of Nayarit and Sonora, on the Pacific coast of México. The specimens from Chamela Bay differ from *A. ayalai* in the structure of the male spicules. In *A. ayalai*, the shorter spicule is "unciform" (claw-like) and the larger is L-shaped. In our specimens, the longer spicule is slender, with a flat dilatation near the distal end, and the shorter is broad and curved. Our specimens most closely resemble *A. girellae* (Yamaguti, 1935) Campana, 1955, which was originally described as *Rhabdochona girellae* in *Girella punctata* from Japan (Yamaguti, 1935). They share the shape and size of the spicules and the distribution of caudal papillae of males: 3 preanal, 1 adanal, and 5 postanal pairs (all sub-ventral). In addition, there are 5 pairs of small lateral papillae that are postnatal. This report represents a new host and locality record.

Kyphosid and girellid fish are thought to be closely related, and girellids have been shifted back and forth from the families Kyphosidae and Girellidae (Martin, 1978). This is the second parasite known to be shared between the host genera *Kyphosus* and *Girella*. *Opisthadena cheni* was originally described from *Girella nigricans* in California (Martin, 1978), although this digenean genus is common in *Kyphosus* species (Linton, 1910; Manter, 1947; Yamaguti, 1970). The finding of *Ascarophis girellae* in *Kyphosus elegans* supports the hypothesized relationship between the host genera.

HABITAT: Stomach.

ACCESSION NUMBER: CNHE 2736.

#### **Anguillicolidae gen. sp. Yamaguti, 1935 (Larvae)**

We collected larval nematodes belonging to an undetermined species in the family Anguillicolidae.

SITE OF INFECTION: Intestine.

#### **Discussion**

Of the 10 helminth species recorded here, 7 are common parasites of the genus *Kyphosus* (*H. oliveri*, *H. nenue*, *H. kyphosi*, *D. ovalis*, *O. dimidia*, *J. dohenyi*, and *F. bucerium*) and *N. aniversaria* parasitizes preferably members of the family Kyphosidae, being previously reported from *K. elegans* and *Sectator ocyurus*. Van Cleave and Manter (1948) and Manter (1949, 1965) have considered the genus *Kyphosus* an

excellent host-parasite system for zoogeographical studies and proposed an origin center and dispersal routes for *Kyphosus* species based on the zoogeographical distribution of their helminth parasites. Manter (1965) proposed an Indo-Pacific origin of this fish genus with secondary dispersion to the Americas via the South Pacific Ocean and via the Eastern Pacific Ocean to the Caribbean Sea. Manter did not have the methodological tools to test *Kyphosus* evolutionary and biogeographical history that are available today in phylogenetic systematics and historical ecology, as described by Brooks (1981, 1990) and Brooks and McLennan (1991, 1993). Although the phylogeny of the genus *Opisthadena* (León-Règagnon et al., 1996) does not support Manter's view of progressive dispersion from the western to the eastern Pacific (it rather supports the notion of an ancient circum-Pacific distribution of the group), our records of species of the genus *Heteroplectanum*, which has been reported in the western as well as in the eastern Pacific, and the genera *Deontacylix* and *Filisoma*, also reported in the Caribbean Sea, suggest that phylogenetic studies of such groups and others highly specific to kyphosids as *Jeanca-denatia*, *Cadenatella*, and *Enenterum* could provide decisive information on the evolutionary history of this host-parasite system.

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